Method for producing images having at least one coded part undetectable by the naked eye

The invention relates to the production at industrial speed of series of images all different from one another. It also relates to the production of such images whose coded part is undetectable by the naked eye but capable of being read at high speed. The invention relates more particularly to the use of these images to implement a process for marking products for purposes of identification and/or monitoring of their movement and flow, said process permitting, at industrial rates of working, the manufacture, the fitting and the recognition of single label texts.

PRIOR ART

The identification of products is often necessary for both social and economic reasons. It is frequently essential, in fact, to recognise without any risk of error:

- the owner of an object,
- the originator of an individual object,
- the origin of a manufactured object etc.

The direct applications of this identification are naturally the combating of theft or counterfeiting, the authentication of works of art, etc.. However, at an industrial and commercial level, for example for the management of stocks with a straight flow, the recognition of products can also be useful in the management of said flows: geographical monitoring of the products, checking of their distribution systems etc..

The economic benefits linked to the identification of products are therefore often considerable, requiring as a result that the methods used have sufficient reliability. However, the means used to recognised manufactured products

must not only be reliable, but also be able to keep pace with the rates of production.

In order to recognise the characteristics of a product, the latter must be the bearer of an original mark preventing any confusion. This recognition mark can be an integral part of the product or be affixed to it during or after its manufacture or its creation.

Methods of marking products by the fitting of labels have proved to be effective. MICRODOT and VIGICODE are in particular involved.

The MICRODOT process makes it possible to print a certain number of parameters on a film cut into pellets 2 mm in diameter on which are printed 5 lines of 15 characters, covering an area of 1 mm by 5/10 mm. The markings made with the use of this process have the major drawback of not resisting abrasion or scraping and consequently exposing the product to falsification.

The VIGICODE process was developed in order to correct this problem. It makes it possible to print a text composed of 6 lines of 18 characters, covering an area of 5/10 mm by 4/10 mm, on a film by a photographic process. Because this text is inserted into the body of the pellet, it resists abrasion and/or scraping.

These two systems permit identification of the owner of the object. Although practical and useful, they suffer from several defects:

- the texts printed on the labels, although of relatively small size, can in certain cases damage the product that bears them,

- the total number of characters on a label is relatively low, limiting as a result the number of different texts, or recognition marks, capable of being printed,

- the printing of a series of labels is carried out on the basis of a single matrix encoder, and the labels printed in large numbers are therefore all identical; thus, MICRODOT and VIGICODE permit the identification only of a family of products and not the product itself; this drawback is major in that the mark of the products can be reproduced by non-authorised persons and affixed to non-authentic products. The marking then loses all its utility.

- they do not propose the use of a code readable at high speed,

- the printing processes are such that the texts can be read only by contrast,

- despite their relatively small size, the labels produced by these processes and their text are, with an effort, distinguishable with the naked eye, which endangers protection.

The bar code is also used to mark products. Its most widely known application is that serving to recognise prices and to control the flows of large distribution products.

Although it offers a greater flexibility of use than the MICRODOT or the VIGICODE, the bar code nevertheless has the major drawback of being of relatively large size, particularly if it is desired to obtain a quasi-infinity of texts. In addition, it has to be suitably oriented to be read. Its reading at high speed has never been able to be realised.

The patent US 4 763 928 describes a process enhancing the reliability of the identification of products by marking the latter with a multitude of micro-labels all bearing the same coded and/or non-coded items of information affixed to sites known only to authorised persons. All the products of one and the same series bear identical labels placed in the same positions. This process has the major drawback of being industrially cumbersome if the number of labels affixed is high, but can be easily exploited if this number is low, since the labels all bear the same information.

The patent US 4 758 703 describes a device and a process for printing a code on a product by a "laser and mask" technique.

The patent US 5 568 555 describes a novel system for coding information by translating it in the form of matrices of dots of different colours and of shades that are themselves different.

The patent application EP-A-0 681 262 describes a process for marking products by applying to them several labels of small sizes but visible to the naked eye and each bearing the same serial number and hence easily reproducible by a non-authorised person.

For the identification of animals, the Indexel process of implantation below the ear of a transponder composed of a very fine copper antenna and a series of ultra-miniaturised transistors arranged in a silicon chip has been designed in order to be able to deliver on demand an unfalsifiable 15-figure number memorised and capable of being read by a bar code reader.

This method is difficult to transpose to an object or a product of everyday consumption, because although the concealment required to effectively deter thieves is

achieved, the implantation on the other hand affects the package in its tamper-resistance.

The industrial requirements give priority in particular to discretion, rapidity of construction and reading, and reliability of the marking of the products.

OBJECT OF THE INVENTION

The present invention is brought about in order to correct the problems encountered with the markings of the prior art. More particularly, it has as its object to meet the following criteria:

- the coding system must have a capacity sufficient to guarantee a quasi-infinity of texts that are all different,

- the text must be inscribed on an area sufficiently small that the marking remains imperceptible,

- it must be readable through 360 °, the need for orientation being incompatible with the imperceptibility of the marking,

- its reading must be compatible with industrial rates of working, i.e. 5 to 9 readings per second.

The invention also has as its object to implement a process for marking products, the reliability of which is augmented by:

- the unique character of the image, that is to say of the recognition sign, affixed,

the resistance of the images thus produced to abrasion and to scraping,

- the dimensions of the coded part chosen so that the latter is not detectable by the naked eye,

- the particular linking of the various stages in order to obtain maximum security during the marking.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a diagram showing the devices used to manufacture an image according to the invention.

Figure 2 is a diagram showing the devices and the stages in a realisation of a marking process according to the invention.

DESCRIPTION OF THE INVENTION

In the processes of the prior art, the creation and the printing of the images are such that it is possible to realise only a single recognition sign per group of products. In the process according to the invention, a device is used which is capable in a relatively short time, in keeping with industrial rates of working, of producing a large number of images that are all different and of printing them simultaneously in order to manufacture sequences of recognition signs. The variety of the characters and their number are sufficient to permit the production of a quasi-infinite quantity of texts all of which are unique. After printing, the pattern generated disappears.

To permit such an operation, an original combination of several devices and technical characteristics is brought about. The latter is shown in Figure 1.

There is combined the use of a computer program of a computer (1), a device for producing images (3), such as

cathode tubes and screens, and a device (5) reproducing this image on a support (6). In a first stage the data (2) are generated, either in random manner or by an algorithm in numerical form in a manner known in engineering. They correspond to a particular code. They are then transmitted to a device (3) capable of converting numerical data (2) into images exploitable visually (4). Translated in this form, the data are simultaneously reproduced, for example by a photographic process, on a physical support (6) constituted by the product for marking itself or any other means such as a film.

One of the characteristics of the image produced by the device mentioned above is its very short life. The visual translation of the numerical data lasts only 1/3 or 1/5 of a second, in fact, and disappears as soon as its carry comes to an end on the support and is then replaced by the following translation. Industrial rates of production of images all of which are different can thus be obtained while avoiding any possibility of the inadvertent disclosure of information.

A device particularly suited to the production of images is a system of the COM type. To date, this equipment has been used only for the small-scale reproduction of existing documents on paper support. In the process according to the invention, it is used to convert the numerical data into images visually exploitable on cathode screen.

The transitory image thus produced is adjusted to the desired dimensions by a potentiometer.

According to a variant of the invention, for practical reasons the transfer of a sequence of images is effected on a belt so as to form a ribbon of images more easy to use.

The reproduction of this image on a physical support, from the matrix or transitory image, is undertaken by various processes. Photographic printing, such as that used to produce micrographics, is particularly suitable. Use is then made of a silver film on a support of polyester, polyethylene, polypropylene, glass, PVC, etc. to effect the printing. The image thus fixed can then undergo various treatments to strengthen its resistance to abrasion or to scraping, to facilitate its fitting or its adherence to the product, etc.. A contrast film, for example, is placed on the printed or imprinted face. It can also be glued on (cold-setting adhesive or heat sealing).

This reproduction can also be obtained by printing, photocomposition, silk screen printing or any process that is suitable and compatible with the information source, that is to say the device producing transitory images.

According to a variant of the invention, the printing is performed tone on tone. To achieve this result, the code is printed with a difference in shade compared with the support which is imperceptible to the naked eye, even after enlargement. The codes thus transferred range up to black on black ground.

According to another variant, some of the visible and identical parts of each label (for example the logotypes) are realised by the application of a mask in front of the cathode screen.

According to another variant of the invention, the image thus formed presents several coded parts associated or not with coded parts, variable or not, and visible to the naked eye.

According to another variant of the invention, the transfer of the image of the cathode screen is effected directly

onto a product, for example a manufactured product, treated beforehand in a suitable manner. The image is then formed for example by photosensitization of the surface of the object or by engraving it directly by the "laser and mask" method. In this case, the mask is composed of the image obtained by use of the process described above.

Another characteristic element of the combination of means permitting the creation of labels meeting the objects listed is the nature of the code used. In order to realise the undetectable part of the label, this code is a dot code or matrix code. Thus, about 500 characters capable of being converted for example into alpha-numeric code are printed per mm^2. The reading of these codes is performed at high speed (5 to 9 per second) and does not require a precise orientation - impossible to obtain in any case because of the size of the coded part - of the object to be identified.

The reading of these codes is performed by a matrix camera.

The labels manufactured by a combination of these various means, that is to say means for producing numerical data, for converting these data and for printing their version in visually exploitable images, are particularly useful for effecting the marking of products for purposes of identification or the monitoring of movements and flows.

In a process for marking of this type, the stage following the production of the images on a support is the fitting of the label bearing the text for recognising the product. This is carried out by any means ensuring the adherence of the label to the product to be marked. It is particularly effected by using a device, a punch, manufactured specially for this process. This punch has the shape of the label to be fitted.

According to a variant, a ribbon of labels is used, the cutting up of which is carried out by controlled punching of the ribbon by this system.

According to another variant of the present invention, the resistance to abrasion is obtained by placing the printed face of the label on the product. In this case, the text is printed beforehand wrong side up and its reading is effected by transparency.

The labels fitted in this way are then read, by a manual or automatic means. In this second case, a matrix camera is used to validate their texts and relate them to the characteristics of the product to be identified. The latter are memorised for example in a data bank to which recourse will be had during the procedure for identifying a product. This process is particularly effective if the texts are readable automatically at high speed.

In the case of a transfer of the code tone on tone, the automatic reading system is equipped with a spectrographic filter. The latter thus makes it possible to analyse the code by wave length difference. Codes ranging up to black on black ground can be read in this way.

According to a variant of this identification process, the memorising of the text of the label can be effected during its production before or during its printing.

The last stage in this process of identifying products is the reading and recognition of the text borne. This reading is such that it enables the sign read to be placed in parallel with those memorised during the reading. A read text whose equivalent is not found in the bank of memorised texts testifies to the lack of authenticity of a product.

SAMPLE EMBODIMENT

The object of the present invention is to permit the realisation of a large-scale marking of products while limiting to the maximum the risks of copying, theft or destruction of this marking in the interests of greater efficiency.

One of the characteristic elements of the process according to the invention is the production at high speed of images bearing numerous characters, the latter themselves being sufficiently varied so as to be able to mark a very large number of products (particularly manufactured products) by a sign peculiar to each one, at industrial rates of working.

In order to meet all these requirements, there is created, for example, an ASCII computer file (7). This file contains the fields required for the realisation of transitory views (3 to 5 per second). These views are obtained by converting the numerical data (2) into visually exploitable images. In the sample embodiment, a COM XR AP of ANACOMP is used, or any apparatus of a similar type, modified for processing 65 micron films. This apparatus (3A) produces coded images (4) on a cathode screen.

Certain zones are optionally visible, the others being reduced (up to 72 times compared with viewing with the naked eye). The texts comprise a certain number of predefined fields. These fields are filled with numerous and varied characters. The images are therefore all different from one another. They include a matrix code and optionally alpha-numeric characters, patterns and/or bar codes. The alphanumeric texts appearing in the form of a matrix card are generated either by a cryptographic algorithm, in this case held by the creator of the file, or at random.

The second stage in this process is the manufacture of the images properly so-called. It is simultaneous with the production of the images. According to a variant, it is preferred to realise a ribbon of images (6A) rather than individual labels. Production in ribbon form is more economic in industrial terms. It also limits the risk of loss, theft, etc..

In this embodiment, the ribbon of images is manufactured from the computer file. Use is then made of a photographic system (5A) fixing the image of the cathode screen or laser with partial or total reduction of that obtained by a potentiometer, then by an optical system. The support on which the transitory image is fixed is a silver micrographic film (6A) itself on a support of polyester, polyethylene, polypropylene, glass, PVC or any other material permitting photographic printing.

The chemical treatment is of the negative type (developer without re-exposure, fixing bath, rinsing and drying). The image is therefore in inverted position (that which is conventionally black opaque is here transparent).

The texts are either black on transparent ground, for reading on a clear support, or white, by chemical treatment during the development, for reading on a dark support, or tone on tone.

The images are separated by a locating block obtained by the addition of a superimposition plate permitting a precise positioning in the fitting module described below. The pitch between two labels is adjusted by programming.

When the recognition sign is not printed directly on the object, the last stage in the marking process properly so-called is the fitting of the label (8) to the product (12).

The cutting up of the labels is not done in advance. It is therefore necessary to use a device that performs this cutting up as well as the definitive adherence of the label to the object. To this end, a punch designed specially for the implementation of the invention is used. It has the shape of the label to be obtained.

The fitting is done by controlled descent of the punch, so as to deposit the punched label on the support. The pressure used is that required for the adherence. It is greater than the latter if it is desired to embed the label in the support.

The punch-matrix clearance is adjusted as a function of the thickness of the ribbon to be punched. The thickness of the matrix is of the order of a millimetre in order to limit the viscous rubbings created by a possible accumulation of adhesive between the punch and the matrix.

The punch can be used manually or automatically. In the case of an automatic use, the principle is as follows:

- advancement of the ribbon and positioning at 0.05 - 0.1 mm by locating by any device, for example optical, of the signal separating the images on the ribbon,

- descent of the punch, initiated by the positioning, the holding in position and the placing in contact of the support with the ribbon of images (a contactor, a photoelectric cell or other is then used), punching of the ribbon and fitting of the label (8) to the support (12) by limitation of the travel of the punch.

After the fitting, the coded text of the label is read by a matrix camera (9) and memorised, for example in a data bank (10), in order that during an identification it can be compared with the signs borne by the checked products. The

reading of these recognition marks is performed by means of an image inversion microscope or by any other means for the automatic reading of dot codes. Within the scope of this example, it uses in particular a DOT CODE reading system, a CCD ½" high-resolution camera and a lighting device comprising a 100 W amplifier and an annular fibre. A specific lens (minimum 100-fold enlargement with mirror) is placed on the camera.

The last stage in the identification process is that of the reading and the comparison of the image borne by a product with all the texts memorised during the manufacture of the ribbons of images.

A consultation node (11) realised according to known processes permits, after the label texts have been studied by the authorised operators, the consultation of interconnected data bases (10) developed for each application of the marking process. This consultation permits decryption of the texts and consequently validates or not the authenticity of the object, indicates its provenance, its owner, etc..

This sample embodiment corresponds to the particular case of the authentication of products. Other embodiments are adaptable to different uses. For example, a restriction to the reading of data items borne by the product, without their comparison with those memorised, is possible. In this case, the stages in the process are substantially the same, with the exception of the consultation of the node (11).

The invention relates in particular to the manufacture at industrial rates of working of images bearing a coded part different for each of them, which is undetectable by the naked eye and capable of being read at high speed. Based on the teachings of this invention, other images are designed such as images formed by several coded parts, by one or

more coded parts and one or more non-coded parts, fixed or variable etc.. It is also possible to envisage affixing several coded labels to the same product.